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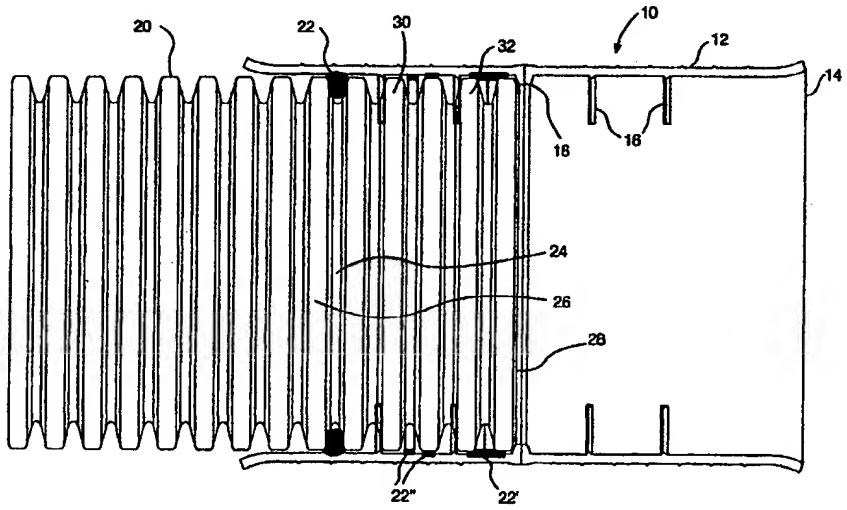

(57) Abstract

A connector (10') for corrugated pipe (20) comprises a sleeve, ledges (16) in the sleeve to engage with corrugations on the pipe to prevent pull–out of the pipe from the sleeve, and a seal (22'/22") moulded into said sleeve and being long enough to span at least two corrugations, whereby the seal will always contact a peak (30, 32) of said corrugations. Alternatively, at least two seals (22") are moulded into the sleeve at spaced positions so that when the pipe is inserted into the connector one or other seal contacts a peak of said corrugations. A method of making such a seal comprises the steps of moulding said sleeve in a mould (100) comprising a sleeve core (54, 56) and an openable cavity (52), an aperture (66) being formed in the sleeve so moulded, and subsequently moulding said seal by injection of thermoplastic elastomer through said aperture into an annular space (80) defined between said sleeve and a seal core (54', 56') said space coinciding with said aperture.

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CORRUGATED PIPE CONNECTOR AND METHOD OF MANUFACTURE

The present invention relates to a connector for pipes and particularly for plastics ducting employed in the telecommunications industry, although also employed in drainage and electricity supply. Such ducting typically comprises flexible plastics tubing which is twin-walled, the outer wall being corrugated in order to facilitate flexing of the pipe or tubing during installation in the ground.

Such tubing is generally made in lengths (typically six-metre lengths) requiring that they be interconnected during installation.

Because the ducting is merely providing a housing for other cables or conduits, there is no especial requirement either for the joint to be strong or for the seal between two connected pipes to be absolute. Nevertheless, it would of course be preferable if at least the seal could be absolute but a more pressing requirement is that the ducting should be inexpensive to manufacture and install.

A joint between adjacent lengths of such ducting is presently effected by installing at each end of the length of ducting a seal element in the form of a sealing ring which is disposed in one of the corrugations of the ducting at a small distance from each end. The seal is normally an elastomeric material and has a relatively deep profile so that it can be seated securely between adjacent corrugations. A connector is provided in the form of a plastics sleeve which has internal teeth. When the sleeve is pressed over the end of the ducting, the teeth engage one or more of the corrugations, thereby providing resistance to pull out of the ducting from the sleeve. In the field, it is therefore only necessary for an installer to insert one length of ducting into the ground after the other and pressing the sleeve over the exposed end of the previously laid ducting (although this can also be done in the factory so that the ducting is supplied with one end connected to a connector). Finally the next length of ducting is inserted into the other end of the connector. The connector sleeve has a surface adapted to bear against the seal and compress it and deform it against the surfaces of the corrugations.

The sleeve is normally made of deformable plastics material such as polypropylene so that the teeth snap over the corrugations. There is normally a central ledge or rib within the sleeve so that there is a positive stop in the centre of the sleeve to allow the user to know when the pipe is pressed fully home in the sleeve. Thus the sealing ring is generally placed, not in the first or second corrugation from the end of a length of ducting, but spaced therefrom by several corrugations so that the corrugations between the end of the pipe and the sealing ring can be employed for being gripped by the teeth. This avoids the necessity of the teeth of the ducting passing over the sealing ring which might have a tendency either to damage the sealing ring or possibly to dislodge it from the corrugation in which it is placed and possibly prevent an effective seal being formed. However, by disposing the seal at a distance from the end of the pipe means that the seal is actually close to the end of the connector. This has the effect of potentially enabling the seal to be broken when a section of pipe including a connection is bent, as is frequently required when the pipe needs to go around corners, objects etc. In this event, it would be advantageous if the seal was deep within the connector so that the distorting effect of the pipe bend would be minimised.

A further disadvantage with the present method is that the forming of the joint is a two-step process. The first step is completed in the factory when a sealing ring is positioned over each end of a length of ducting and the connector is inserted at one end. The second step is effected in the field when the joint is completed by insertion of the free end into the sleeve. A further corollary problem is that, when the ducting is cut to an appropriate length, the installer must position a new sealing ring at the appropriate distance from the cut end, and this may not be completed properly and is in any event a further installation step.

A yet further disadvantage is that the seal rings are expensive components and are much larger than is absolutely necessary to effect the required seal. They are only so bulky as presently arranged so as to ensure that they remain in place in the appropriate corrugation and are not dislodged during insertion of the pipe end into the connector sleeve.

Thus, it is an object of the present invention to provide a connector sleeve and a method of making a connector sleeve so that these problems are solved or at least their effects are mitigated.

In accordance with the present invention, there is therefore provided, in a first aspect, a joint between a connector for corrugated pipe and one end of said pipe, the connector comprising a sleeve, ledges in the sleeve to engage with corrugations on the pipe to prevent pull-out of the pipe from the sleeve, and a seal moulded into said sleeve and being long enough to span at least two corrugations, whereby the seal will always contact a peak of said corrugations.

In a second aspect, the present invention provides a joint between a connector for corrugated pipe and one end of said pipe, the connector comprising a sleeve, ledges in the sleeve to engage with corrugations on the pipe to prevent pull-out of the pipe from the sleeve, and a seal moulded into said sleeve at a position thereof such that when the pipe is fully inserted into the connector the seal contacts a peak of said corrugations.

In a third aspect, the present invention provides a joint between a connector for corrugated pipe and one end of said pipe, the connector comprising a sleeve, ledges in the sleeve to engage with corrugations on the pipe to prevent pull-out of the pipe from the sleeve, and at least two seals moulded into said sleeve at spaced positions thereof such that when the pipe is inserted into the connector one or other seal contacts a peak of said corrugations.

In a fourth aspect, the present invention provides a connector for the joint as defined above.

In a fifth aspect, the present invention provides a connector for corrugated pipe, the connector comprising a sleeve, ledges in the sleeve to engage with the pipe to prevent pull-out of the pipe from the sleeve, and a thermoplastic elastomeric seal moulded

into said sleeve.

In a sixth aspect, the present invention provides a method of making a connector for corrugated pipe, the connector comprising a sleeve, ledges in the sleeve to engage with the pipe to prevent pull-out of the pipe from the sleeve, and a thermoplastic elastomeric seal disposed in said sleeve, wherein said method comprises the steps of moulding said sleeve in a mould comprising a sleeve core and an openable cavity, an aperture being formed in the sleeve so moulded, and subsequently moulding said seal by injection of thermoplastic elastomer through said aperture into an annular space defined between said sleeve and a seal core, said space coinciding with said aperture.

Said sleeve core may be different from said seal core. Preferably, however, said sleeve and seal cores are the same core, wherein said core has sections collapsible from one diameter for forming said sleeve to a smaller diameter for forming said seals.

The openable cavity employed for moulding the sleeve may be different from the openable cavity for forming the seal, and in which event said aperture may be formed by a stud in said sleeve forming cavity. Preferably, however, said cavity is the same cavity in each step and said aperture is formed by a retractable pin in one or both of the cavity or sleeve core.

In this way it is feasible to mould the entire connector in a single mould in two sequential steps.

The invention is further described hereinafter, by way of example, by reference to the accompanying drawings, in which:

Figure 1 is a side view, partly in section, of a prior art joint, but embodying seal arrangements in accordance with the present invention;

Figure 2 is a perspective view, partly cut away, of a connector in accordance with the present invention; and

Figures 3a and b are sections through moulds for forming connectors in

accordance with the present invention.

With reference to the drawings, a prior art connector 10 comprises a plastics sleeve 12 having a mouth 14 and teeth 16 formed on internal surfaces of the sleeve 12. A central rib 18 divides the sleeve 12 into two ends. A corrugated pipe 20 has an elastomeric sealing ring 22 disposed in annular groove 24 between adjacent corrugations 26 of the pipe 20. The groove 24 is, in this case, the sixth groove from open end 28 of the pipe 20.

The pipe 20 is manufactured from twin-wall plastics material, such as high-density polyethylene, co-extruded with the outer wall which is substantially simultaneously corrugated (the inner wall remaining smooth. This construction of ducting provides crush strength for the ducting so that cabling carried by the ducting is physically protected, while at the same time providing great flexibility for the ducting so that it can be bent to tight radiuses. The inner layer of the ducting is smooth, however, so that insertion of cabling is facilitated.

In manufacture, the ducting is made in six-metre lengths (typically) with a sealing ring 22 being inserted at each end. Also at the manufacturing site a sleeve connector 10 is slid over one end of the pipe 20 so that each length of pipe 20 is supplied with a sealing ring 22 at each end and a connector 10 at one end. Thus assembly in the field is merely a question of pushing the "seal end" of one pipe into the "connector end" of another pipe. Teeth 16 are positioned so as to engage corrugations 30,32, the material of the sleeve 12, and of the pipe 20, being such that the teeth and/or corrugations deform when the sleeve is pushed over the corrugations of the pipe 20 and the teeth snap back behind the corrugations.

Turning to Figure 2, an embodiment of the present invention is shown, in which seal elements 22' are here moulded into connector 10' adjacent central rib 18. Indeed this is also shown at the bottom of Figure 1 where the size of the seal can be compared with the prior art seal 22. It is possible to have the seal at this depth within the sleeve because, since the seal is mounted in the connector and not on the pipe, there is no

risk of dislodging the seal or damaging it during insertion of the pipe in the sleeve.

Although shown close to the central rib 18, there is nothing to prevent the seal being positioned elsewhere, should that be desired, although the seal needs to have an axial length at least equal to the pitch of the corrugations so that the surface of the corrugations will always be in contact with the seal. Indeed the seal could be formed along most of the length of the sleeve, if desired. However, there are two exceptions to this general rule. The first is where the seal 22' is disposed at some fixed distance from the rib 18 so that, assuming the pipe is always cut in a groove 24, it can always be guaranteed that a corrugation 26 is at the same distance from the end of the pipe as the seal 22' is from the rib 28. Thus the seal could in this instance be very short. The second situation is to have at least two seal rings moulded into the sleeve 12 separated from one another by half a pitch length of the corrugations so that, whatever position the pipe is in relation to the sleeve 12, at least one of the seal rings will be in contact with a corrugation. This is shown at 22" in Figure 1.

Turning to Figures 3a and b, a mould 100 comprises an openable cavity 52 and two core parts 54,56. A port 58 in the cavity 52 gives access to an annular space 60 defined between the cores 54,56 and cavity 52 through which thermo-plastic polymer such as polypropylene can be injected to form the sleeve 12. The cavity 52 has two studs 64 which form apertures 66 in the sleeve 12.

Referring to Figure 3b, the apertures 66 are arranged to coincide with port 70 in cavity 52' whereby thermo-plastic elastomer may be injected through the apertures 66 in the sleeve 12 into annular spaces 80 so as to form seals 22'. Preferably, the seals 22' are adjacent a central rib 28, so that, assuming the core parts 54,56 split in a radial plane coincident with the rib 18, only those parts of the core which form the seals 22' are dragged over the seals 22' when the cores are separated and the cavity opened. However, this is not essential since the intruding depth of the seal 22', 22" into the internal surface of the sleeve 12 does not have to be large. Therefore, once solidified, the sleeve with the seal in place could simply be sprung over and off the cores 54,56. However, a further advantage with

disposing the seal close to the rib is that its position relative to the corrugations, assuming the pipe is always cut in a groove, is assured, and the length of the seal need not be long to ensure effective sealing against a corrugation as long as the pipe is pressed fully home against rib 18.

Connector 10' could be manufactured by known techniques where cavity 52 and cores 54,56 are both different from cavity 52' and cores 54',56'. However, in the case of cavity 52, this can be arranged the same as cavity 52' if studs 64 take the form of retractable pins. Such retractable pins could be in the cavity 52 or in the cores 54,56. Similarly, the cores 54,56 can be the same as the cores 54',56' if the cores are provided with sections 82 having variable diameter so that, while the sleeve 12 is being moulded, the diameter of sections 82 is the same as the rest of the core 54,56 (although section 82 might even more preferably have an enlarged diameter so as to form a groove in the internal surface of the sleeve 12 to form a seal for the seal). However, when the seals 22' are being moulded, the section 82 is contracted so as to have a reduced diameter and form the spaces for the seals 22'. In this event, the retractable pins may be in the cavity 52, coinciding with injector 70 which the pins, when extended, serve to close, but open when they are retracted. However, they could be in the cores 54,56 forming part of the retractable diameter sections 82.

In this way, the entire connector 10' is formed in a single piece of apparatus in a two-stage process. Finally, although the seal 22' is shown in a simple form with a rectangular section, it might advantageously have a more sophisticated form, such as in the form of a lip seal or having a serrated section.

Claims

1. A joint between a connector for corrugated pipe and one end of said pipe, the connector comprising a sleeve, ledges in the sleeve to engage with corrugations on the pipe to prevent pull-out of the pipe from the sleeve, and a seal moulded into said sleeve and being long enough to span at least two corrugations, whereby the seal will always contact a peak of said corrugations.

2. A joint between a connector for corrugated pipe and one end of said pipe, the connector comprising a sleeve, ledges in the sleeve to engage with corrugations on the pipe to prevent pull-out of the pipe from the sleeve, and a seal moulded into said sleeve at a position thereof such that when the pipe is fully inserted into the connector the seal contacts a peak of said corrugations.

3. A joint between a connector for corrugated pipe and one end of said pipe, the connector comprising a sleeve, ledges in the sleeve to engage with corrugations on the pipe to prevent pull-out of the pipe from the sleeve, and at least two seals moulded into said sleeve at spaced positions thereof such that when the pipe is inserted into the connector one or other seal contacts a peak of said corrugations.

4. A connector for the joint as claimed in claim 1, 2 or 3.

5. A connector for corrugated pipe, the connector comprising a sleeve, ledges in the sleeve to engage with the pipe to prevent pull-out of the pipe from the sleeve, and a thermoplastic elastomeric seal moulded into said sleeve.

6. A method of making a connector for corrugated pipe, the connector comprising a sleeve, ledges in the sleeve to engage with the pipe to prevent pull-out of the pipe from the sleeve, and a thermoplastic elastomeric seal disposed in said sleeve, wherein said method comprises the steps of moulding said sleeve in a mould comprising a sleeve core and an openable cavity, an aperture being formed in the sleeve so moulded, and subsequently

moulding said seal by injection of thermoplastic elastomer through said aperture into an annular space defined between said sleeve and a seal core, said space coinciding with said aperture.

7. A method as claimed in claim 7, in which said sleeve core is different from said seal core.

8. A method as claimed in claim 7, in which said sleeve and seal cores are the same core, wherein said core has sections collapsible from one diameter for forming said sleeve to a smaller diameter for forming said seals.

9. A method as claimed in claim 6, 7 or 8, in which the openable cavity employed for moulding the sleeve is different from the openable cavity for forming the seal, and said aperture is formed by a stud in said sleeve forming cavity.

10. A method as claimed in claim 6, 7 or 8, in which said cavity is the same cavity in each step and said aperture is formed by a retractable pin in one or both of the cavity or sleeve core.

11. A method as claimed in any of claims 6 to 10 to make a connector as claimed in claims 4 or 5.

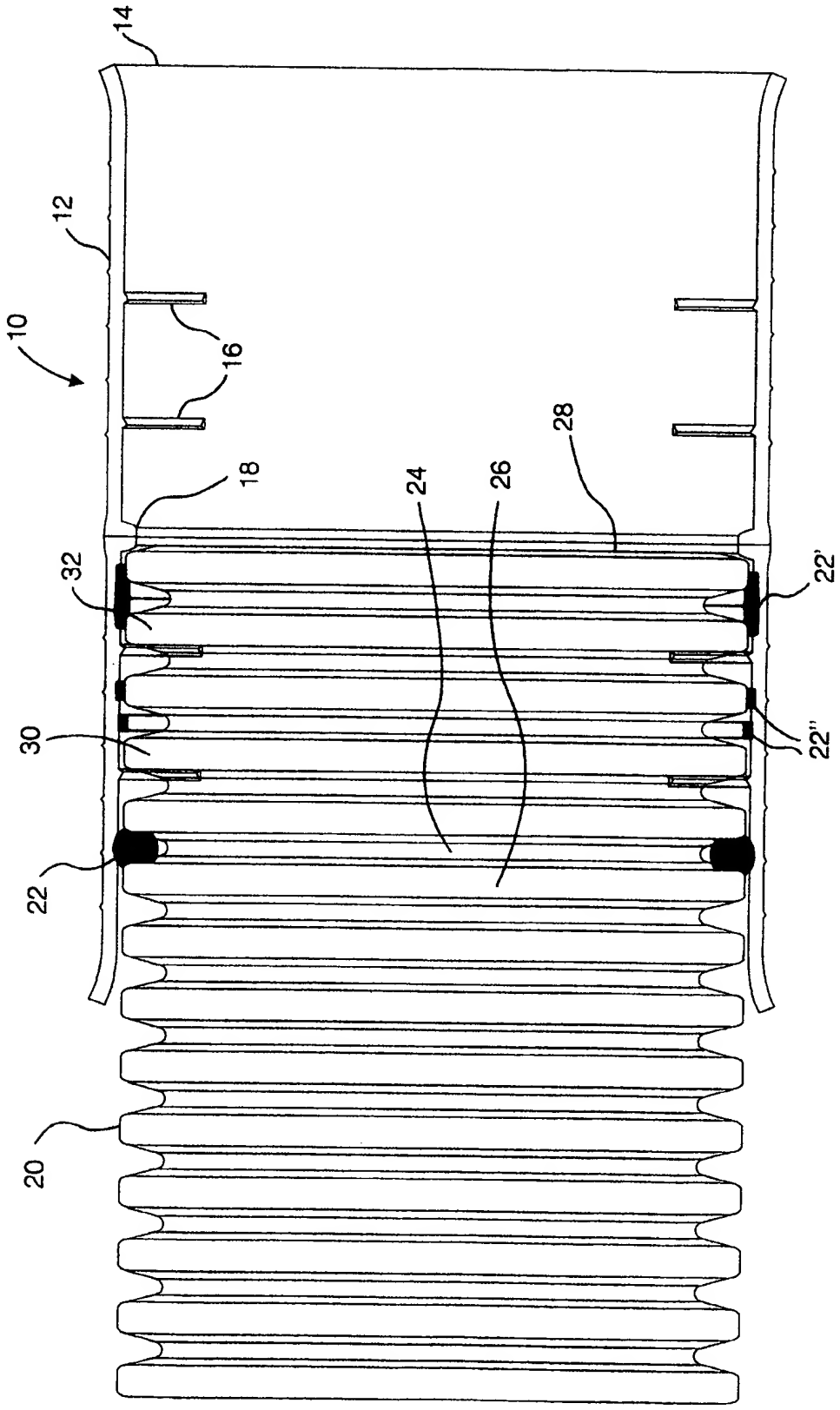

Fig. 1

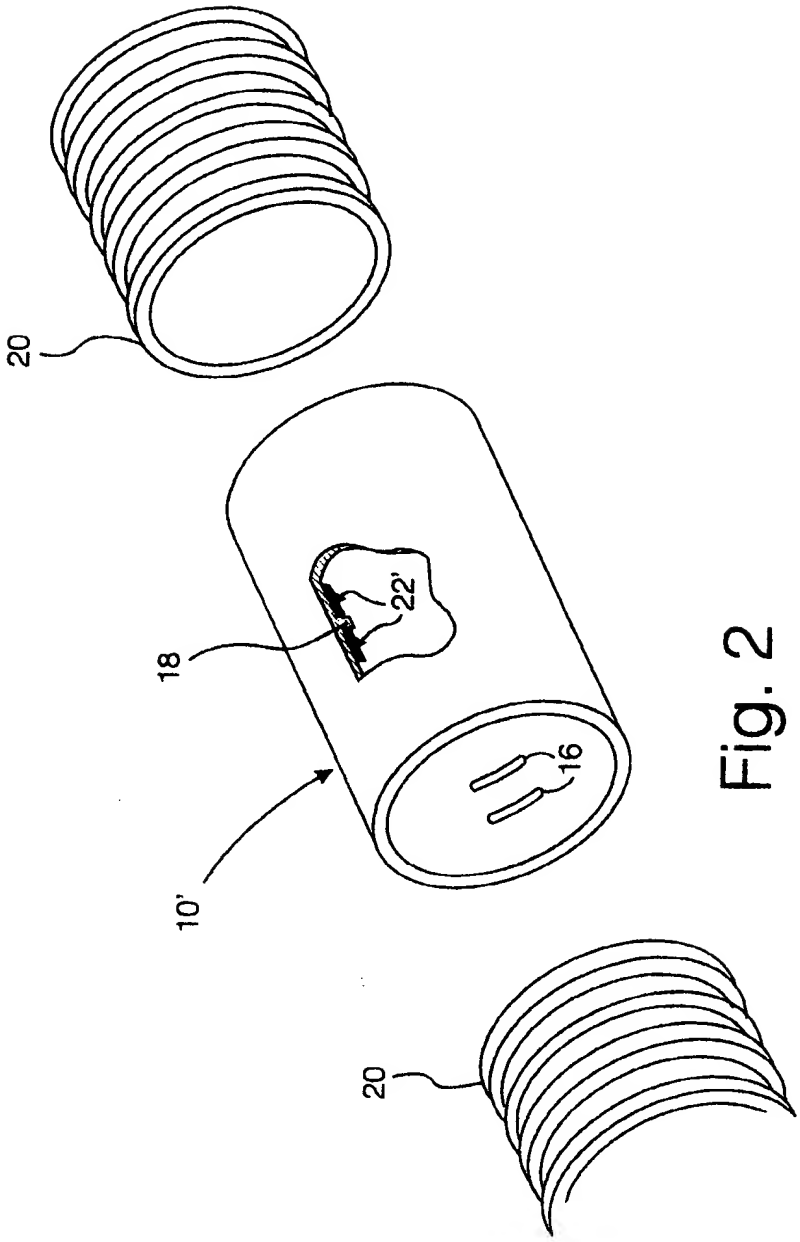

Fig. 2

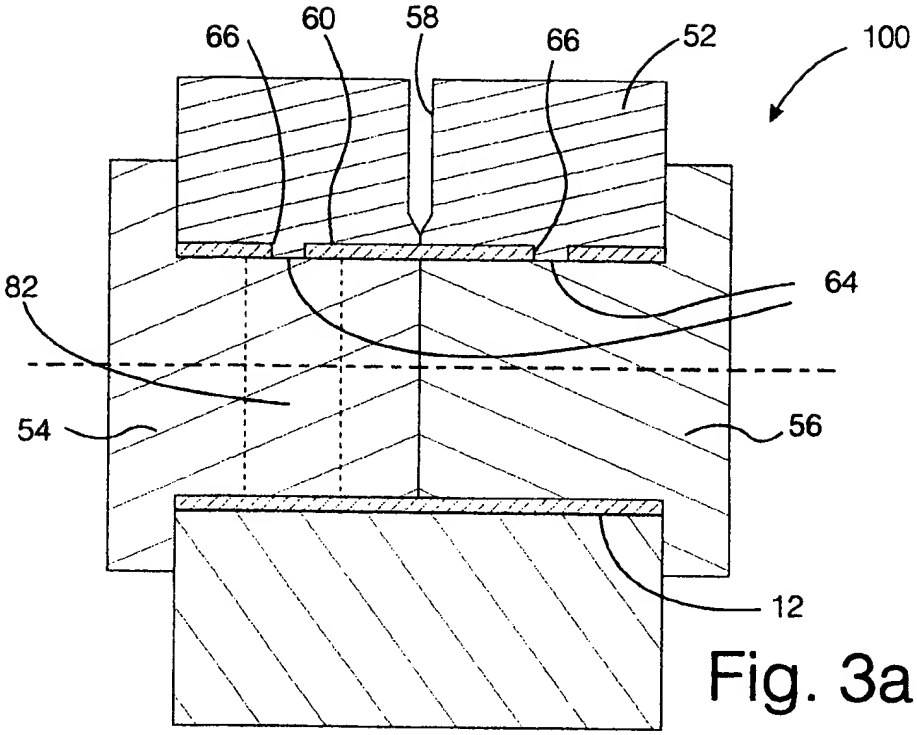

Fig. 3a

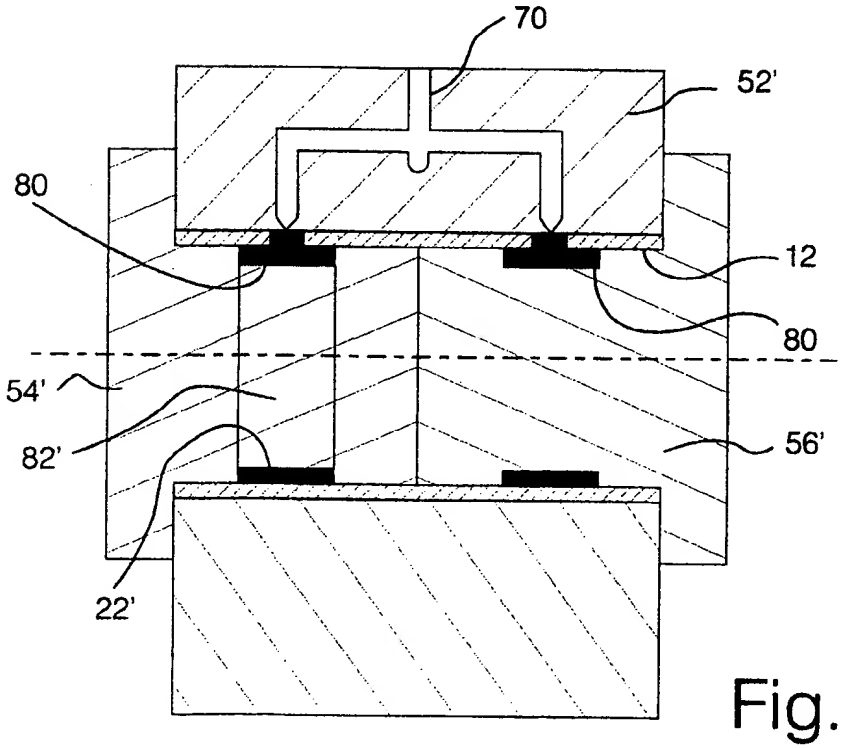

Fig. 3b

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16L25/00 F16L47/06 F16L21/03 B29C45/16

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